

Amendments to the Claims

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

1. (currently amended) A fusion protein comprising a heterologous polypeptide fused to at least a portion of a major coat protein of a virus selected from the group consisting of a filamentous phage, a lambda phage, a Baculovirus, a T4 phage and a T7 phage, wherein the major coat protein is a variant of a wild type major coat protein of the virus.
2. (canceled)
3. (original) The fusion protein of claim 1, wherein the phage is a filamentous phage, the major coat protein is gpVIII and the heterologous polypeptide is fused to the N-terminus or the C-terminus thereof.
4. (original) The fusion protein of claim 1, wherein the major coat protein is a filamentous phage coat protein variant which contains at least one amino acid residue selected from the list below in the position indicated:

<u>Residue Number</u>	<u>Amino Acid Residue</u>
1	E, L, V, Q, D, I, N
2	R, H, F, W, E, K, Y, D
3	T, E, L, S, D, I, V, A
4	D, R, H, E, K
5	R, H, N, D, K, Q, E
6	Y, W, S, I, L, F, T, V
7	T, N, S
8	D, H, R, E, K

9	E, Q, T, D, N, S
11	W, I, V, Y, L, F
12	R, H, N, E, D, K, Q
13	I, L, E, Q, A, V, D, T, N, S
14	L, I, V
15	D, R, N, E, K, H, Q
16	E, V, L, F, D, I, A, S, G
17	E, V, L, I, A, T, D
18	L, V, I
19	L, T, Q, E, I, V, S, A, N, D
20	R, D, H, N, Q, K, E
21	W, Y, I, L, F, V
22	W, F, Y
23	W, Y, I, V, H, K, F, L, R
24	I, Q, L, N, V
25	S, L, I, T, V
26	A, I, V, G, L, M
27	N, T, S
28	I, L, V
29	K, R, F, W, H, Y
30	I, V, L

5-6. (canceled)

7. (original) The fusion protein of claim 1, wherein the variant has 2 - 50 altered residues relative to the wild type coat protein sequence.

8. (original) The fusion protein of claim 1, wherein the heterologous polypeptide is an antibody or a fragment thereof or a cytokine or a cytokine receptor.

9. (original) A replicable expression vector comprising a gene fusion, wherein the gene fusion encodes the fusion protein of claim 1.
10. (canceled)
11. (currently amended) Host cells comprising the vector of claim 20 9.
12. (currently amended) A virus particle displaying the fusion protein of claim 1 on the surface thereof.
- 13-28. (canceled)
29. (new) The fusion protein of claim 1, wherein the heterologous protein comprises at least one amino acid substitution in one or more regions of the molecule.
30. (new) The fusion protein of claim 1 wherein the filamentous phage is selected from the group consisting of Ff, Ike, If1, Pf1, Pf3, Xf, fd, f1 and M13.
31. (new) The fusion protein of claim 1, wherein the filamentous phage coat protein variant is selected from the group consisting of SEQ ID NOS. 2, 3, 4, 5, 6, 7 and 8.
32. (new) The fusion protein of claim 1, wherein the filamentous phage coat protein is a hyper-functional variant of the major coat protein that increases the number of fusion proteins incorporated into a virus particle.
33. (new) The fusion protein of claim 1, wherein the filamentous phage coat protein variant is a hypo-functional variant of the major coat protein that decreases the number of fusion proteins incorporated into a virus particle.

34. (new) The fusion protein of claim 1, wherein the virus is a lambda phage.

35. (new) The fusion protein of claim 34, wherein the major coat protein includes at least a portion of a variant of the coat protein selected from the group consisting of pE, pD, pB, pW, pFII, pB*, pXI, pX.2, pJ, pV, pG, pM and pT.

36. (new) The fusion protein of claim 1, wherein the virus is a T4 phage.

37. (new) The fusion protein of claim 36, wherein the major coat protein includes at least a portion of a variant of the coat protein selected from the group consisting of the small outer capsid protein (SOC), the highly antigenic outer capsid protein (HOC), fibritin and whisker protein.

38. (new) The fusion protein of claim 1, wherein the virus is a T7 phage.

39. (new) The fusion protein of claim 38, wherein the major coat protein includes at least a portion of a variant of the coat protein selected from the group consisting of 10B capsid protein and the 10A capsid protein.

40. (new) The fusion protein of claim 1, wherein the virus is a Baculovirus.

41. (new) The fusion protein of claim 40, wherein the major coat protein includes at least a portion of a variant of the gp64 coat protein.

42. (new) A phage vaccine comprising the fusion protein of claim 1.

43. (new) The fusion of claim 1, wherein the major coat protein variant comprises an amino acid sequence of amino acids 1-10 selected from the group consisting of SEQ ID NO:143, SEQ ID NO:145, SEQ ID NO:147, SEQ ID NO:149, SEQ ID NO:151, and SEQ ID NO:153.

44. (new) The fusion protein of claim 1, wherein the heterologous polypeptide is separated from the major coat protein by a linking peptide.

45. (new) The fusion protein of claim 44, wherein the linking peptide is selected from the group consisting of SEQ ID NO:110, SEQ ID NO:112, SEQ ID NO:114, SEQ ID NO:116, SEQ ID NO:118, SEQ ID NO:134, SEQ ID NO:136, SEQ ID NO:138, SEQ ID NO:193, SEQ ID NO:195, SEQ ID NO:197, SEQ ID NO:199, SEQ ID NO:201, SEQ ID NO:203, SEQ ID NO:205, SEQ ID NO:207, SEQ ID NO:209, SEQ ID NO:211, SEQ ID NO:213, SEQ ID NO:215, SEQ ID NO:217, SEQ ID NO:219, SEQ ID NO:221, SEQ ID NO:223, SEQ ID NO:225, SEQ ID NO:227, SEQ ID NO:229, SEQ ID NO:231, SEQ ID NO:233, SEQ ID NO:235, SEQ ID NO:237, SEQ ID NO:239, SEQ ID NO:241, SEQ ID NO:243, SEQ ID NO:245, SEQ ID NO:247, SEQ ID NO:249, SEQ ID NO:251, SEQ ID NO:253, SEQ ID NO:255, SEQ ID NO:257, SEQ ID NO:259, SEQ ID NO:261, SEQ ID NO:263 and SEQ ID NO:265.

46. (new) The fusion protein of claim 8, wherein the heterologous protein is an antibody or a fragment thereof.

47. (new) The fusion protein of claim 46, wherein the antibody binds to a target selected from the group consisting of, cytokines, cytokine receptor superfamily receptors, hematopoietic growth factor superfamily receptors, human leukocyte surface markers, prolactin receptors, growth hormone receptors, ciliary neurotrophic factor receptors, C-Mpl receptors, erb2, erb3, erb4, IL-10, IL-12, IL-13 and IL-15.

48. (new) The fusion protein of claim 47, wherein the human leukocyte surface marker is selected from the group consisting of CD1a-c, CD2, CD2R, CD3-CD10, CD11a-c, CDw12, CD13, CD14, CD15, CD15s, CD16, CD16b, CDw17, CD18-C41, CD42a-d, CD43, CD44, CD44R, CD45, CD45A, CD45B, CD45O, CD46-CD48, CD49a-f, CD50-CD51, CD52, CD53-CD59, CDw6O, CD61, CD62E, CD62L, CD62P, CD63, CD64, CDw65, CD66a-e, CD68-CD74, CDw75, CDw76, CD77, CDw78, CD79a-

b, CD8O-CD83, CDw84, CD85-CD89, CDw90, CD91, CDw92, CD93-CD98, CD99, CD99R, CD100, CDw101, CD102-CD106, CD107a-b, CDw108, CDw109, CD115, CDw116, CD117, CD119, CD120a-b, CD121a-b, CD122, CDw124, CD126-CD129, and CD130.

49. (new) The fusion protein of claim 47, wherein the cytokine receptor superfamily receptor is selected from the group consisting of IL-2b, IL-2g, IL-3, IL-4, IL-5, IL-6, IL-7, IL-9, granulocyte-macrophage colony-stimulating factor, granulocyte colony-stimulating factor, erythropoetin, leukemia inhibitory factor, and oncostatin M.

50. (new) The fusion protein of claim 1, wherein the major coat protein variant comprises an amino acid sequence of amino acids 11 to 20 selected from the group consisting of SEQ ID NO:158, SEQ ID NO: 160, SEQ ID NO: 162, SEQ ID NO:164, SEQ ID NO:166, SEQ ID NO:168, SEQ ID NO:170, SEQ ID NO:172, SEQ ID NO:174, SEQ ID NO:176, SEQ ID NO:178, SEQ ID NO:180.

51. (new) The fusion protein of claim 1, wherein the major coat protein variant comprises an amino acid sequence of amino acids 21 to 30 selected from the group consisting of SEQ ID NO: 185, SEQ ID NO:187, SEQ ID NO:189 and SEQ ID NO:191.